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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* STEVEN DON ARNOLD

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Appeal 2007-4074  
Application 10/647,046  
Technology Center 3700

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Decided: February 15, 2008

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Before TERRY J. OWENS, JENNIFER D. BAHR and JOSEPH A. FISCHETTI,  
*Administrative Patent Judges.*

OWENS, *Administrative Patent Judge.*

DECISION ON APPEAL

The Appellant appeals from a rejection of claims 1, 3-9, 11-17, 19 and 20,  
which are all of the pending claims.

## THE INVENTION

The Appellant claims an exhaust gas recirculation system and method.

Claims 1 and 16 are illustrative:

1. An Exhaust Gas Recirculation (EGR) system providing a mixture of exhaust gas and intake air to the intake of an internal combustion engine, the system comprising:

a turbocharger including a compressor with more than one stage, wherein intake air is compressed in at least one first stage of the compressor, and a mixture of the compressed intake air compressed in the at least one first stage of the compressor and exhaust gas, which exhaust gas has not passed through a turbine, is compressed in at least one second stage of the compressor;

a diesel particulate filter disposed to filter the exhaust gas; and

an EGR cooler disposed to receive filtered exhaust gas from the diesel particulate filter before the filtered exhaust gas enters the compressor.

16. A method of providing exhaust gas recirculation to an internal combustion engine comprising the steps of:

maintaining a pressure of cooled exhaust gas produced by the engine, which gas has been previously filtered and which has not passed through a turbine at a first intermediate pressure less than a pressure at an intake manifold of the engine;

increasing a pressure of intake air to a second intermediate pressure;

mixing the exhaust gas and pressurized  
intake air to form a mixture; and  
boosting the pressure of the mixture to a  
pressure sufficient to meet a mass flow demand of the  
engine

#### THE REFERENCES

Khair	US 5,771,868	Jun. 30, 1998
Woollenweber	US 6,062,026	May 16, 2000
Coleman	US 6,205,785 B1	Mar. 27, 2001
Gladden	US 6,301,889 B1	Oct. 16, 2001

#### THE REJECTIONS

The claims stand rejected under 35 U.S.C. § 103 as follows: claims 1 and 3 over Gladden in view of Woollenweber; claims 1, 3, 5-9 and 11-15 over Gladden in view of Woollenweber and Khair; claim 4 over Gladden in view of Woollenweber and Coleman; claims 16, 17 and 19 over Woollenweber in view of Khair; and claim 20 over Woollenweber in view of Khair and Gladden.

#### OPINION

We affirm the Examiner's rejections.

Rejection of claims 1 and 3 over  
Gladden in view of Woollenweber

Gladden discloses an internal combustion engine (10) having a turbocharger (12) that recirculates exhaust gas from a volute (34) of a turbine (24) to an interstage duct (64) between two compressor wheels (46, 48) of a multi-stage

compressor (26) (abstract; col. 3, ll. 15-19; col. 4, ll. 49-50). Ambient intake air (86) is compressed in the first stage of a multi-stage compressor 26, and is mixed in interstage duct 64 with exhaust gas from volute 34, the exhaust gas optionally having been cooled (in optional cooler 79) but not having passed through turbine 24 (col. 4, l. 57 – col. 5, l. 1; fig. 1). Before that mixing, the optionally cooled exhaust gas is washed using a wash injector (84) to lessen or eliminate fouling of downstream mechanical components (col. 4, ll. 21-26; col. 5, ll. 24-27). The mixture of air and washed exhaust gas is compressed in the second stage of multi-stage compressor 26 (col. 5, ll. 3-9).

Woollenweber discloses an internal combustion engine exhaust gas recirculation system wherein exhaust gas that has not passed through a turbine (15) passes through an exhaust gas conduit (49) to a mixing valve (35) where the exhaust gas is mixed with inlet air that has been pressurized in a turbocharger compressor (18), and then the mixture has its pressure boosted by a motor driven compressor (22) and enters the intake manifold (13) of the internal combustion engine (col. 8, l. 58 – col. 9, l. 33; fig. 5). Exhaust gas conduit 49 has therein an optional particulate trap (41) that can be placed somewhere in the conduit, and an exhaust gas cooler (45) (col. 9, ll. 28-30).

The Appellant argues that “[n]either Woollenweber et al. nor Gladden et al. disclose a filter disposed prior to the EGR cooler, as required by claim 1” (Br. 7), and that the Examiner has not provided evidence that placing a particulate filter at any position in an exhaust gas recirculation system to clean the exhaust gas before it is delivered back to the engine is common knowledge in the art (Br. 5, 8). Regardless of whether such filter placement was common knowledge in the art, Woollenweber’s teaching that a filter (particulate trap 41) can be placed somewhere in exhaust gas conduit 49 (col. 9, ll. 28-30) would have indicated to one of ordinary skill in the art that the filter can be placed in any desired location in that conduit including the portion between exhaust gas manifold 12 and exhaust gas cooler 45 (fig. 5). Thus, placing a filter before Gladden’s exhaust gas cooler 79 would have been *prima facie* obvious to one of ordinary skill in the art to further clean the recirculation exhaust gas.

The Appellant argues that the inventor has discovered that filter efficiency increases dramatically as the filter temperature is increased (Br. 5-6). To the extent that the Appellant is arguing that the increased efficiency is an unexpected result that overcomes the *prima facie* case of obviousness, the argument is not persuasive because it is not supported by evidence. *See In re Sullivan*, 498 F.3d 1345, 1351 (Fed. Cir. 2007) (“Evidence rebutting a *prima facie* case of obviousness can include: ‘evidence of unexpected results,’ *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1369 (Fed. Cir. 2007)”).

The Appellant argues that in Woollenweber there is no understanding of the importance of filter efficiency or compressor damage as discovered by the present inventor (Br. 5-6; Reply Br. 3-4). That argument is not convincing because it is directed toward a limitation not in the claims. *See In re Self*, 671 F.2d 1344, 1348 (CCPA 1982). Regardless, both Gladden's disclosure of cleaning exhaust gas to prevent fouling of downstream mechanical components (col. 4, ll. 22-26) and Woollenweber's disclosure of an optional exhaust gas particulate trap (41) (col. 9, ll. 27-30) indicate some level of understanding of the importance of filter efficiency and potential damage caused by particulates.

For the above reasons we are not persuaded of reversible error in the rejection of claims 1 and 3 over Gladden in view of Woollenweber.

Rejection of claims 1, 3, 5-9 and 11-15 over  
Gladden in view of Woollenweber and Khair

Khair discloses an internal combustion engine exhaust gas recirculation system wherein exhaust gas that has not passed through a turbine (15) is mixed with inlet air, and the mixture is compressed in a motor driven compressor (22), further compressed in a turbocharger's compressor (18), cooled in an intercooler (24), and sent to the engine's intake manifold (13) (col. 4, ll. 28-54; fig. 1). An exhaust gas recirculation conduit (38) includes an optional particle filter or trap (29) upstream of a recirculation exhaust gas cooler (45) (col. 6, ll. 13-14; fig. 1).

Khair indicates that particle filter or trap 29 helps in alleviating problems caused by solid particulate matter and its effect on the downstream compressors (20, 22) and intercooler 24 (col. 6, ll. 5-14; fig. 1).

The Appellant argues that Gladden's ambient air 86 is first compressed by the blades of compressor wheel 46 before being combined with exhaust gas in interstage duct 64 (Br. 7). Compressing the intake air before it is mixed with exhaust gas is what the Appellant's claim 1 requires.

The Appellant points out that Woollenweber mixes compressed air with recirculation exhaust gas whereas Khair mixes uncompressed inlet air with recirculation exhaust gas and then compresses the mixture (Br. 5; Reply Br. 2-3). The Appellant argues that combining Woollenweber and Khair is improper because the principle of each reference would be changed. *See id.* The Appellant does not explain, and it is not apparent, why placing Woollenweber's particulate trap 41 before, rather than after, recirculation exhaust gas cooler 45 would change Woollenweber's principle of operation. The inlet air still would be compressed before being mixed with the recirculation exhaust gas. Woollenweber's particulate trap 41 in exhaust gas conduit 49 must be placed either before or after recirculation exhaust cooler 45. Woollenweber teaches that particulate trap 41 can be placed somewhere in that conduit (col. 9, ll. 28-30), and Khair teaches that the disclosed particle filter or trap (29) positioned before the recirculation exhaust gas cooler (45) is effective in helping to alleviate the adverse effect of solid particulate matter on the downstream compressors and intercooler (col. 6, ll. 5-14). Hence, one of



ordinary skill in the art would have been led by the combination of Woollenweber and Khair to place Woollenweber's particulate trap 41 before recirculation exhaust gas cooler 45 to alleviate the adverse effect of solid particulate matter on Woollenweber's downstream compressor (22). *See KSR Int'l. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1742 (2007) ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense").

We therefore are not persuaded of reversible error in the rejection of claims 1, 3, 5-9 and 11-15 over Gladden in view of Woollenweber and Khair.

Rejection of claim 4 over Gladden in  
view of Woollenweber and Coleman

The Appellant argues that Coleman "does not disclose a filter disposed prior to the EGR cooler, as required by claim 1" (Br. 8). Coleman is relied upon by the Examiner for a disclosure of an exhaust gas recirculation system having a variable geometry turbocharger as required by claim 4 (Ans. 12). Gladden and Woollenweber are relied upon as rendering obvious a filter prior to a recirculation exhaust gas cooler (Ans. 11). As pointed out above, the Appellant has not persuaded us of reversible error in the Examiner's combination of Gladden and Woollenweber with respect to a filter upstream of a recirculation exhaust gas cooler.

Rejection of claims 16, 17 and 19  
over Woollenweber in view of Khair

The Appellant argues regarding claims 16 and 17 that Woollenweber and Khair are not combinable (Br. 4-6; Reply Br. 2-3). That argument is not persuasive for the reasons given above regarding the rejection over Gladden in view of Woollenweber and Khair.

With respect to claim 19 the Appellant argues that neither Woollenweber nor Khair discloses a two stage compressor (Br. 6-7). Claim 19, which depends from claim 16, requires that the step of increasing the pressure of intake air “comprises compressing the intake air with a first stage of a two stage compressor.” The Appellant’s argument is not persuasive because Woollenweber discloses mixing recirculation exhaust gas with air compressed in a first stage of compression (using turbocharger compressor 18, fig. 5) (col. 9, ll. 8-10), and compressing the mixture using a second stage compressor (motor driven compressor 22, fig. 5) (col. 11, ll. 28-29). The Appellant argues that both Woollenweber and Khair disclose “two separate turbochargers, each with a single stage compressor” (Reply Br. 4). That is incorrect. Both Woollenweber and Khair disclose only one turbocharger, numbered 14 in both references. That turbocharger’s compressor is disclosed by Woollenweber as “effecting the first stage of compression” (col. 5, ll. 58-59), and Woollenweber discloses that “the second stage of compression is provided by a motor-driven compressor 22” (col. 11, ll. 60-61). The Appellant’s claim 19 does not require that the two stage compressor is a single unit. The Appellant argues

that “[i]t is well known in the art that two separate single stage compressors are not the same as, or equivalent to, a two stage compressor (which is typically part of a single turbocharger)” (Reply Br. 4). That argument is not well taken because it is merely unsupported attorney argument, and arguments of counsel cannot take the place of evidence. *See In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

Hence, we are not convinced of reversible error in the rejection of claims 16-19.

#### DECISION

The rejections under 35 U.S.C. § 103 of claims 1 and 3 over Gladden in view of Woollenweber, claims 1, 3, 5-9 and 11-15 over Gladden in view of Woollenweber and Khair, claim 4 over Gladden in view of Woollenweber and Coleman, claims 16, 17 and 19 over Woollenweber in view of Khair, and claim 20 over Woollenweber in view of Khair and Gladden are affirmed.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2006).

AFFIRMED

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